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An Interdisciplinary Analysis of Multispectral
Satellite Data for Selected Cover Types in
the Colorado Mountains, Using Automatic Data
Processing Techniques

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(E75-10104) AN INTERDISCIPLINARY ANALYSIS
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A NEW LARGE-SCALE STRUCTURAL FEATURE IN THE SAN JUAN MOUNTAINS

By

D. W. Levandowski & R. L. Borger

In the San Juan Mountains there exists a group of structural and topographic features which suggest a common origin. The relative positions of the San Juan Depression with the Silverton and Lake City Calderas, and the Platoro and Summitville Calderas indicate they are possibly on the edge of a large circular feature.

The relationship was first noticed on ERTS frame E-1173-17202-7 02 and verified by SKYLAB 3, S-190B photographs 310-313, Roll 83. The Silverton and Lake City Calderas (as defined by their bounding valleys) and the elliptical shape of the West Needle Mountains (as outlined by the valleys of the Animas River, Cascade and the South Fork of Mineral Creek) define a portion of an arc (Fig. 1). To locate the center of this arc the semi-major axes of the three ellipses are drawn and their perpendicular bisectors constructed. The average loci of the points where the bisectors cross estimates a point for the center of the arc (Fig. 1-01). The distance between the center of the Silverton Caldera and the constructed center may be used as a radius to draw a full circle (Fig. 1-02). With the circle drawn it can be seen that the Platoro, Summitville, San Luis and LaGarita Calderas all lie on the circumference of the circle (Fig. 1-03).

Comparison with the 1:250,000 scale Durango Geologic Map reveals a series of radial and arcuate faults concentric with the major circular feature (Fig. 1-03). Such a fracture pattern implies that the circular feature may represent the extent of a major domal uplift in the area. Such an uplift was proposed by Larsen and Cross (1956). The uplift was very likely due to the sub-crustal emplacement of the parent magma of the San Juan volcanics and intrusives. The "broad doming" led to the formation of a zone of tensional ring fractures which acted as conduits of release for the magma and the eventual development of the various calderas. The ring fracturing was probably incomplete with hinging occurring in the southern and southwestern portions of the dome accounting for the lack of development of caldera structures in that portion of the area.

MONTHLY PROGRESS REPORT

December 1974

A. Overall Status and Progress to Date

Geological Assessment

The geological investigation is proceeding very nearly as outlined in the Milestone Plan with the following exceptions:

1. There will be no mapping of "hot spots" as no S192 thermal scanner data has been received over the area of interest which was covered by SL3.
2. The mapping of the structure has been delayed until the 1:250,000 enlargements of the S190B photography are received. The photography was ordered in November from the EROS Data Center in Sioux Falls.

The majority of December was devoted to the preparation of a short synopsis on a large-scale structural feature observed in the San Juan Test Site. This synopsis will be included under Significant Results.

Hydrological Features Survey

The past month has been devoted to preparations of the illustrations for the final report on the spectral analysis of snow cover and clouds in the La Sal Mountains area. This part of the project is essentially finished and the final conclusions and recommendations will be ready by the next monthly progress report.

The mapping of the areal extent of snow cover in the Granite Peaks Test Site has been temporarily halted because of the lack of topographic maps (1:24,000) north of the Lemon and Vallecito Reservoirs. However, we expect to obtain them from INSTAAR in the near future. Also we have been waiting for the overlay of the topographic digital data onto the SKYLAB and ERTS MSS data in order to study the influence of topography on the spectral characteristics of snow.

We are also working on procedures to calibrate the thermal infrared MSS data (channel 13; 10.20-12.5 μm band) for the SL2 pass of the Granite Peaks Colorado Test Site.

B. Recommendations

The contract is now four months away from completion. If any analysis is to be accomplished on the SL3 data, it should be sent as soon as possible. Otherwise, the contract shall terminate before preprocessing and analysis can be attempted.

In order to determine the accuracy of the thermal band of the SL2 S192 experiment it would be helpful to have MSS data from Mission 238 (NC-130 24 channel scanner data) collected on June 6, 1973.

C. Expected Accomplishments

A data set containing ERTS, scene ID 1317-17204, SKYLAB-2 S192 and topographic data should be completed during the month of January. This data set will be overlaid and geometrically corrected to assist in the data analysis sequence.

D. Significant Results

The following report was prepared by Dr. Donald W. Levandowski and R. L. Borger, his graduate student, and is being submitted as a significant result. This information has been sent to our Technical Monitor, Dr. Rigdon Joosten, and will be presented in a February 18 symposium at the University of Kansas by Dr. Levandowski.

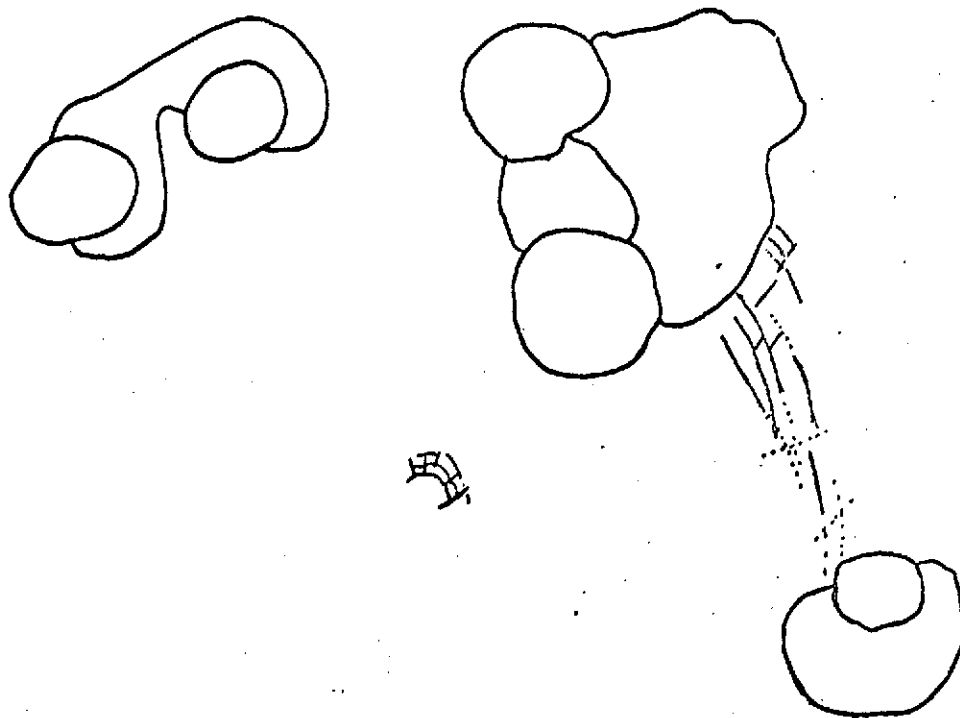


Fig.1-03 Features from 1:250,000 Durango Geologic Map (generalized).
(To be overlayed on Figure 1)

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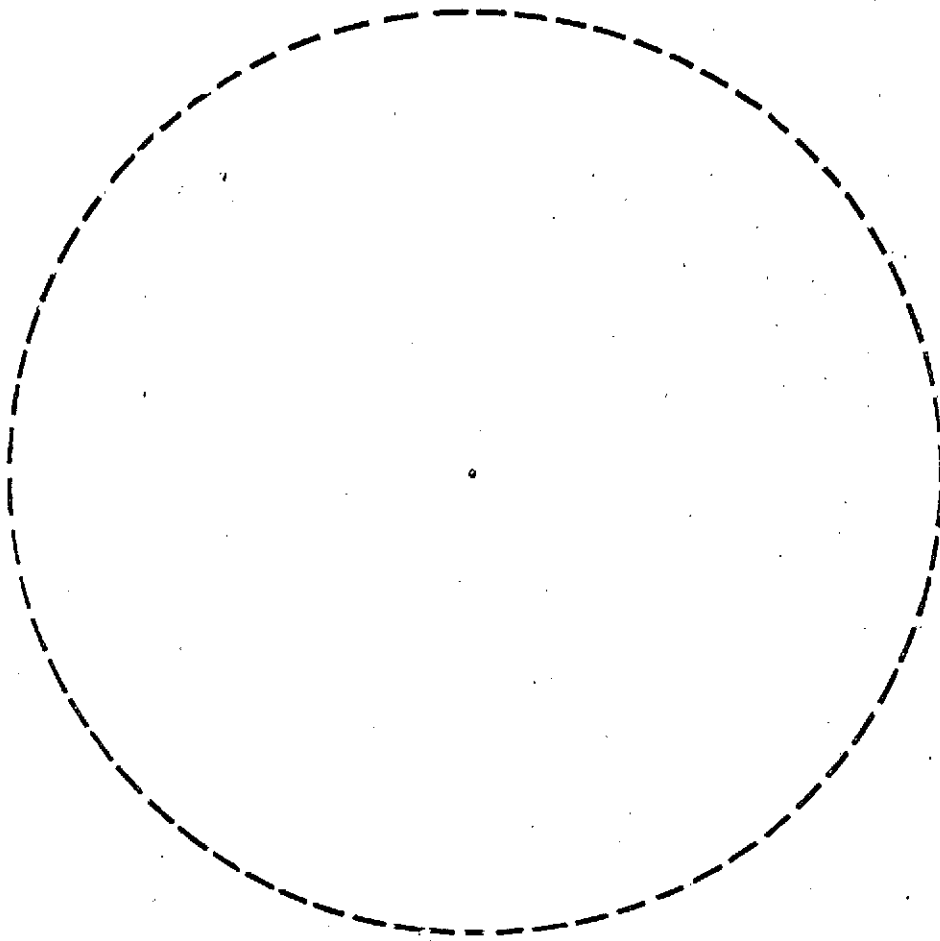


Fig.1-02 Circle
(To be overlayed on Figure 1)

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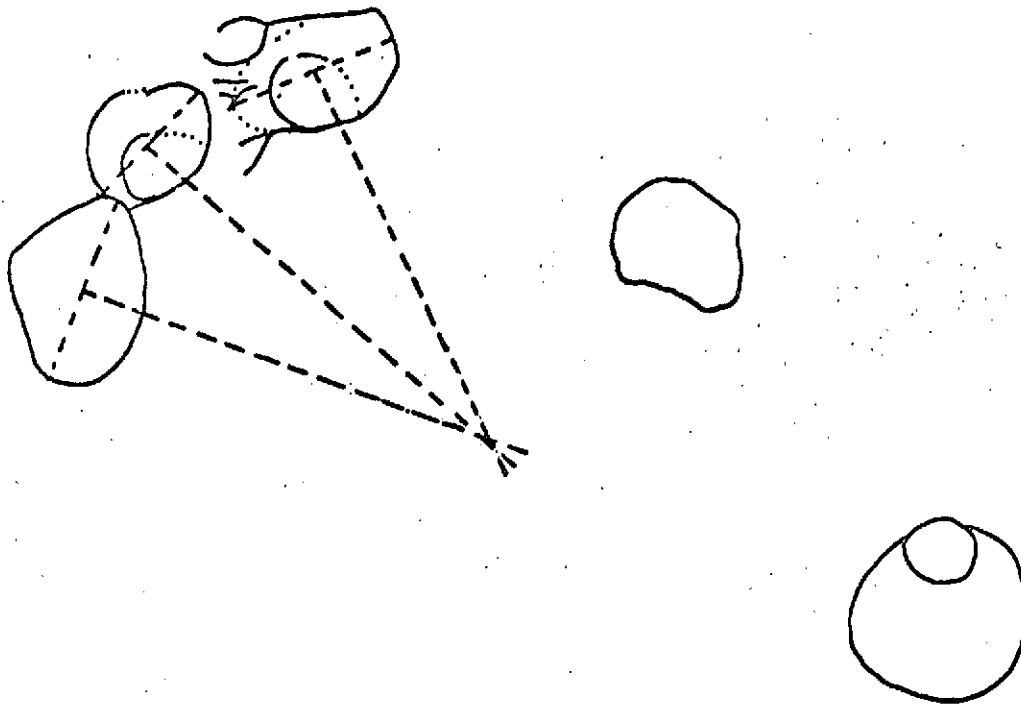


Fig.1-01 Calderas observed on SKYLAB photography and center construction.
(To be overlayed on Figure 1)

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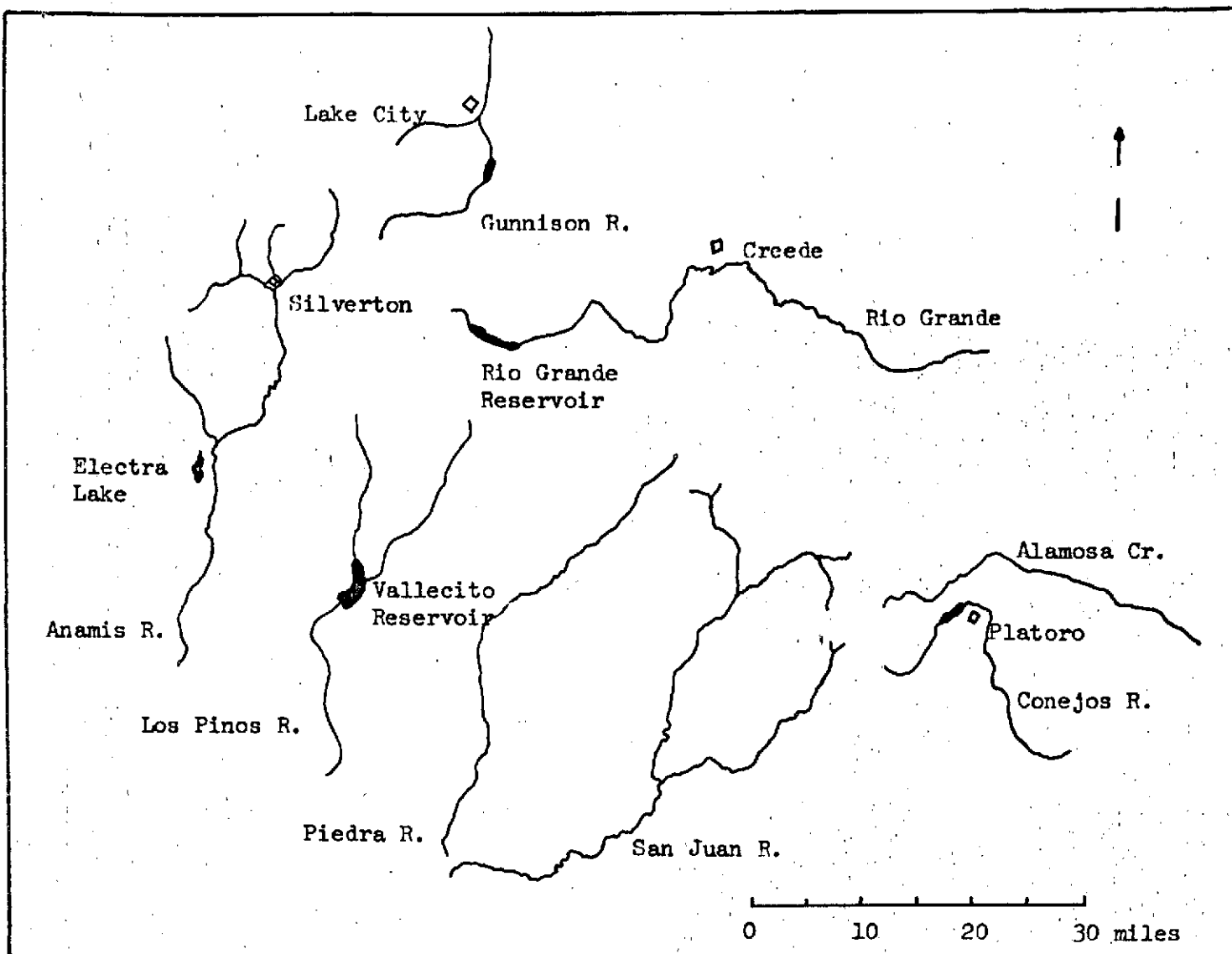


Fig.1 Generalized Drainage Map

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E. Summary Outlook

Detailed analysis of the overlayed SL2, ERTS and topographic data will begin during the month of January. A comparison of the Exotech spectra taken from the Silverton area rock samples will also begin in January.

If any analysis whatsoever is to be accomplished on the SL3 data, the data must be sent to LARS as soon as possible.

F. The following is a trip report submitted by Mike Fleming for his January 6 and 7th trip to INSTAAR.

January 17, 1975

MEMORANDUM

TO: ✓ R. M. Hoffer & S. G. Luther

FROM: M. D. Fleming

RE: January 6 and 7th Trip to INSTAAR

The following is a summary of the topics that were discussed with Dr. Paula Krebs, Dave Groeneveld and Steve Loranger during my recent trip to INSTAAR Mountain Research Station at Ward, Colorado.

SKYLAB

Mesa Verde Display: Paula said that the National Park Service at Mesa Verde had a large display case available for a remote sensing display. It was Paula's understanding that the Park personnel were going to draw up a display but at this time nothing has been done. Because of the desirability to have the display set up by this Spring, Paula is currently planning to draw up a display herself and ask the Park Service for ideas and suggestions, in addition to those already reported.

Vegetation Classification System: Much time was spent discussing possible classification systems and possible names to replace the titles of the current system (Level 1 and Level 2). Table 1 is the classification system that resulted from our discussions. The biomes category (very similar breakdown used by the International Biological Programme [IBP]) would replace the current Level 1 and the formation category would replace the current Level 2. Any suggestions on improving this system are encouraged.

Acreage Estimates: Dave and Steve are continuing to use dot grids to estimate the acreages of the formation types (Level 2) for each 1/4 quad in the Granite Peaks Test Site. The expected date of completion is January 17th.

Test Fields: As another evaluation of the test fields to be used in the SKYLAB contract, a grayscale printout will be sent to INSTAAR that has all of the test fields outlined. Dave will classify each test field by API techniques using only the WB-57 photography and the U.S.G.S. topographic quadrangle sheets. If this approach gives a high accuracy, it would be possible to use this technique to select test fields and reduce the amount of type mapping required. This way, the only areas that would have to be type mapped would be the small clustering (training) areas. The test fields would only have to be identified.

TABLE 1

Biomes

Coniferous Forest

Deciduous Forest

Tundra

Grassland

Water

Formation

Spruce-fir
 Douglas fir
 Ponderosa pine
 Pinyon-Juniper Woodland

Aspen
 Riparian
 Oak-Mahogany Bushland

Bare Rock
 Alpine Meadow (tundra)
 Snow & Ice

Meadow (parkland)
 Agricultural

Water